

Normal TTE Examination, Doppler Echocardiography and Normal Antegrade Flow Patterns

Pravin Patil, MD FACC FASE
Associate Professor of Medicine
Director, Cardiovascular Disease Training Program
Lewis Katz School of Medicine at Temple University

Disclosures

- ✓ No relevant financial disclosures



Normal Echocardiography

Why do we need to review this?

- ✓ Recognize pathology when it exists
- ✓ ASCeXAM
 - Standardized image acquisition
 - Image optimization
 - Anatomic identification
 - Chamber quantification
 - “Less known” normal structures
 - AUC/Indications/Contraindications



Appropriate Use

Indication	Appropriate use score (1–9)
Murmur or Click With TTE	
34. Initial evaluation when there is a reasonable suspicion of valvular or structural heart disease	A (9)
35. Initial evaluation when there are no other symptoms or signs of valvular or structural heart disease	I (2)
36. Re-evaluation in a patient without valvular disease on prior echocardiogram and no change in clinical status or cardiac exam	I (1)
37. Re-evaluation of known valvular heart disease with a change in clinical status or cardiac exam or to guide therapy	A (9)
Native Valvular Stenosis With TTE	
38. Routine surveillance (<3 y) of mild valvular stenosis without a change in clinical status or cardiac exam	I (3)
39. Routine surveillance (≥3 y) of mild valvular stenosis without a change in clinical status or cardiac exam	A (7)
40. Routine surveillance (<1 y) of moderate or severe valvular stenosis without a change in clinical status or cardiac exam	I (3)
41. Routine surveillance (≥1 y) of moderate or severe valvular stenosis without a change in clinical status or cardiac exam	A (8)

- ✓ Appropriate Use Criteria for Echocardiography
 - J Am Soc Echocardiogr 2011;24:229-267



Standardized Image Acquisition



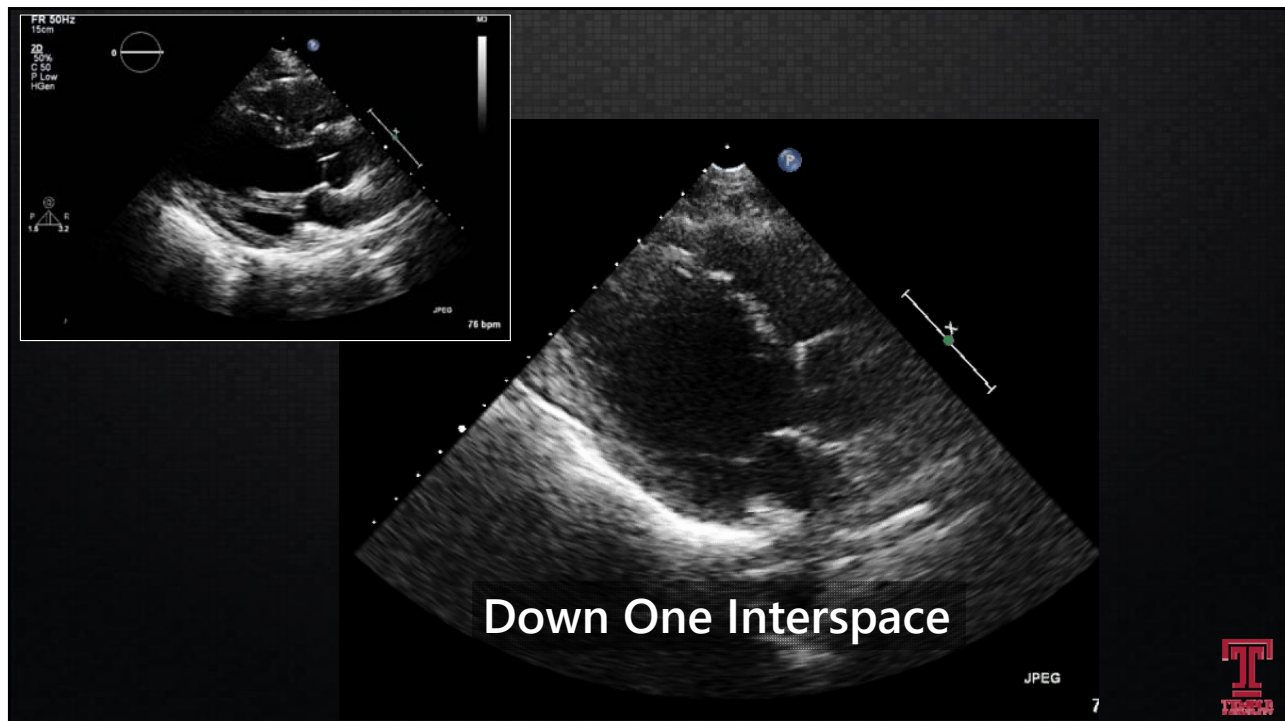
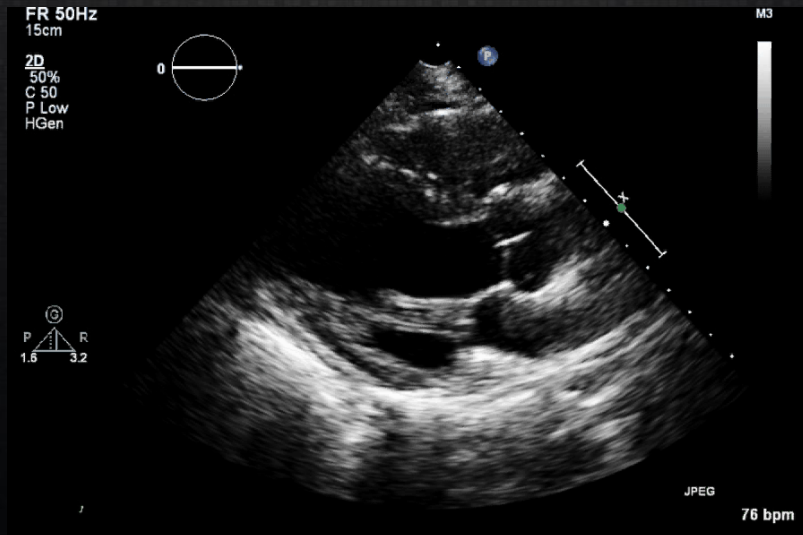
Parasternal Long Axis

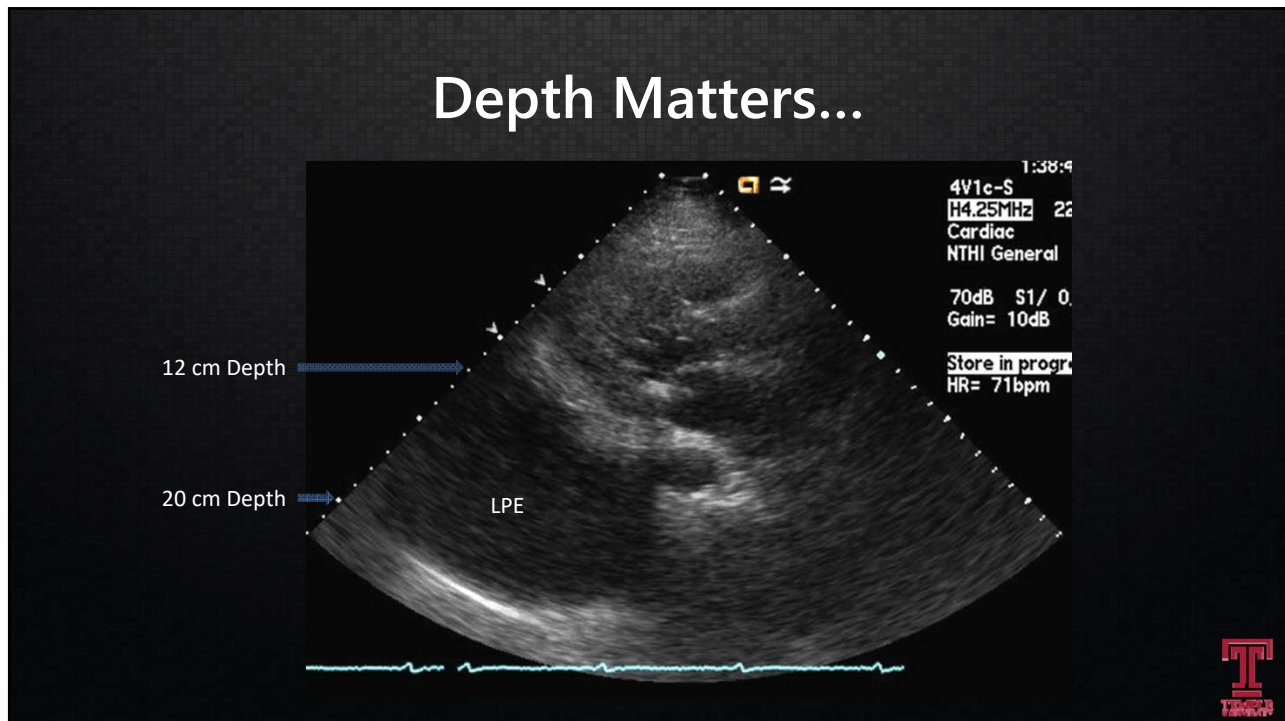
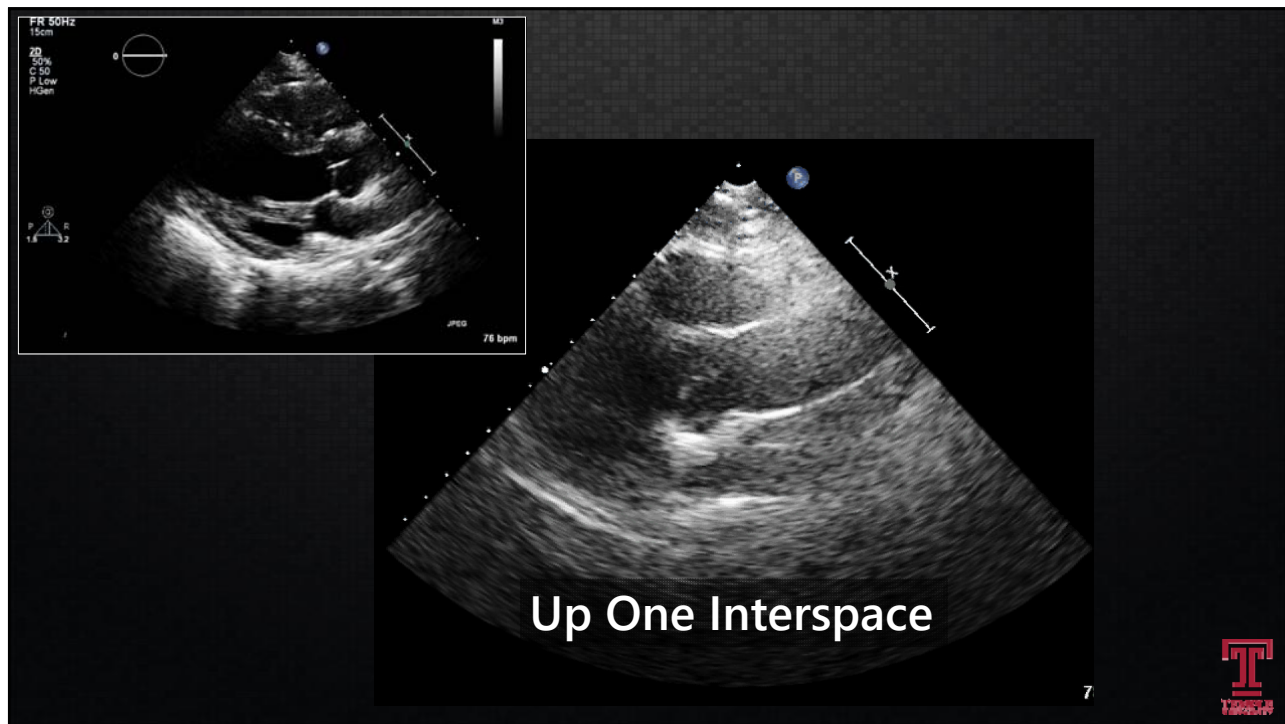


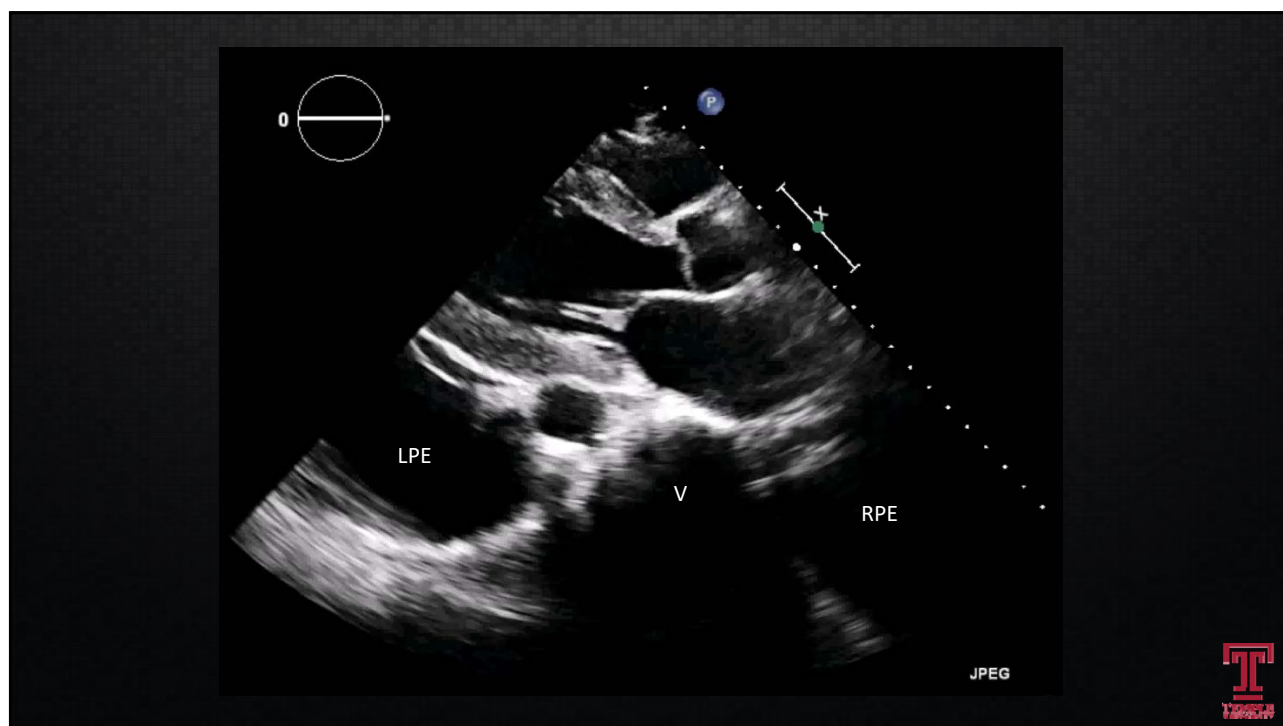
- 3rd-4th Intercostal space
- Index marker to R shoulder
- Two depths
 - Cardiac: 12-16 cm
 - Effusion: 20-24 cm



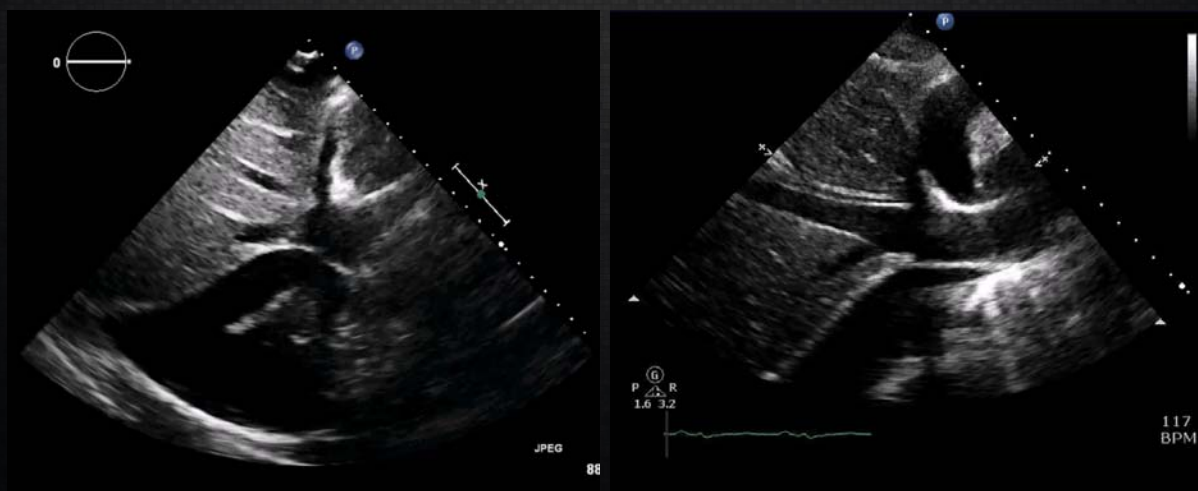
Parasternal Long Axis



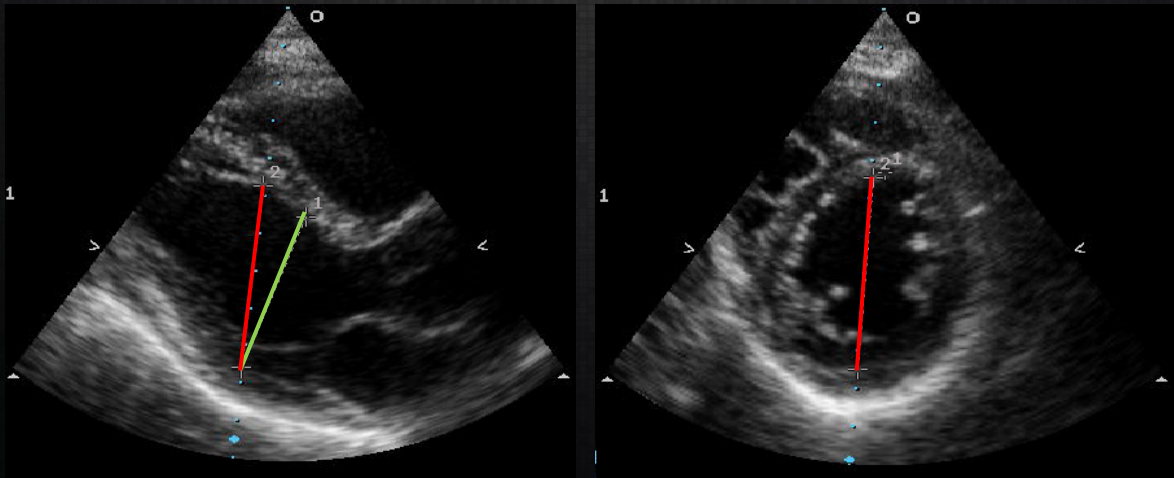




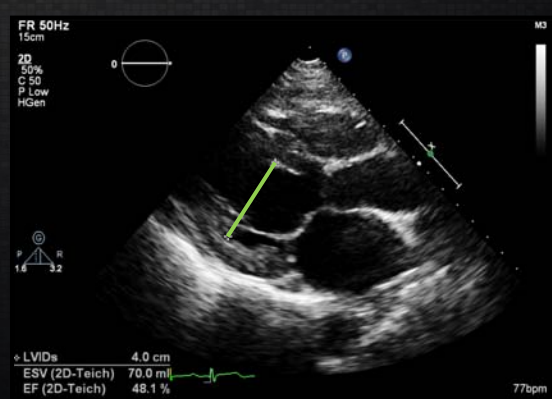
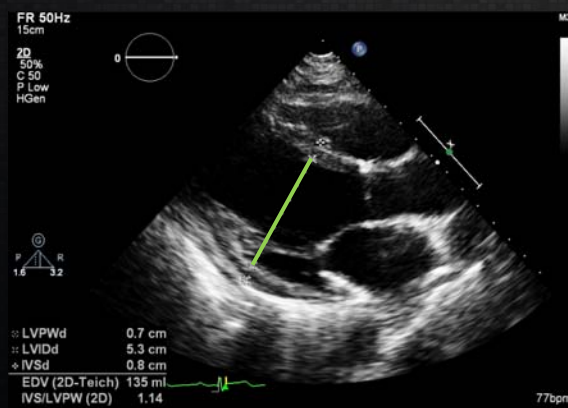
Effusions Everywhere..



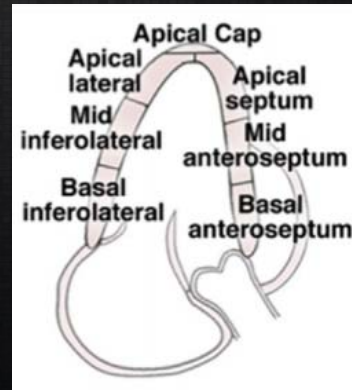
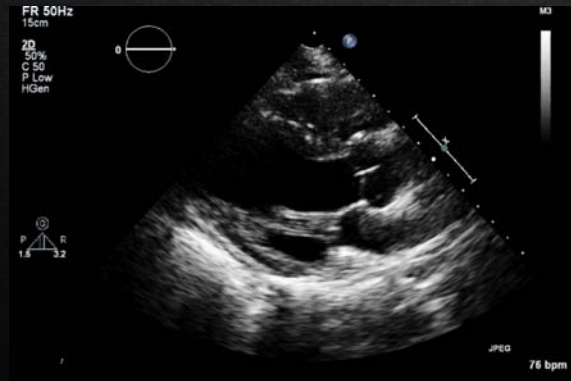
Off-Axis Measurements



On-Axis Measurements



ASE/AHA 17 Segment Model



ASE Chamber Quant Guidelines, JASE 2015



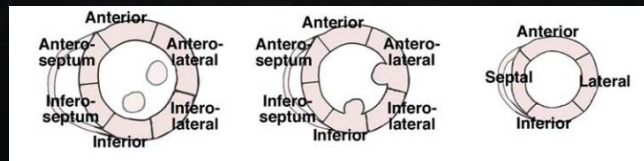
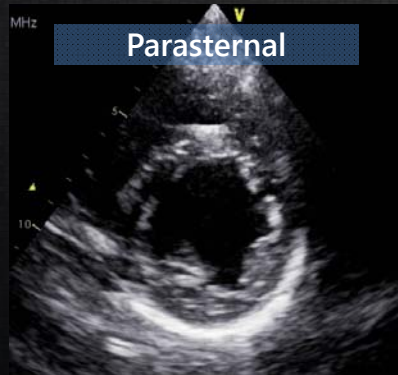
Parasternal Short Axis



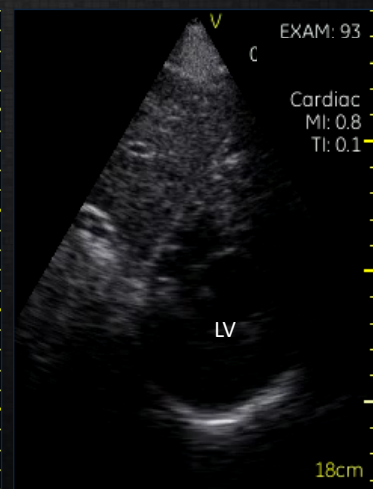
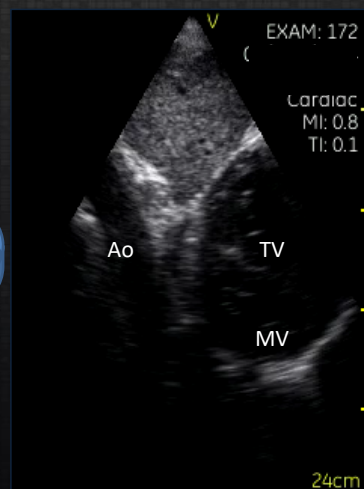
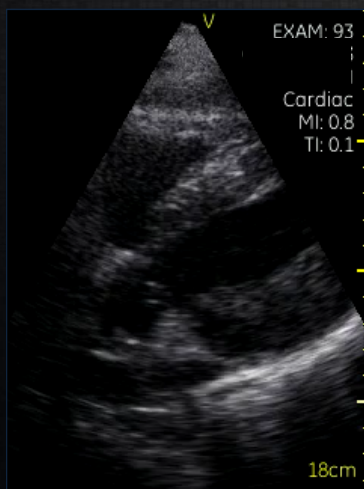
- Rotate 90° from PLAX to the left shoulder
- Tilt transducer down the left flank to pan heart
- Depth 12-16 cm



Short Axis LV



Subcostal Saves the Day!



Cardiac POCUS!



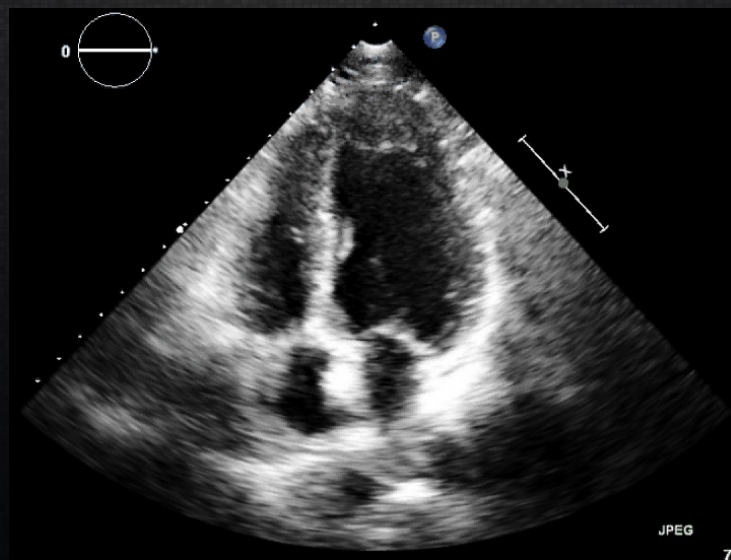
Apical 4 Chamber

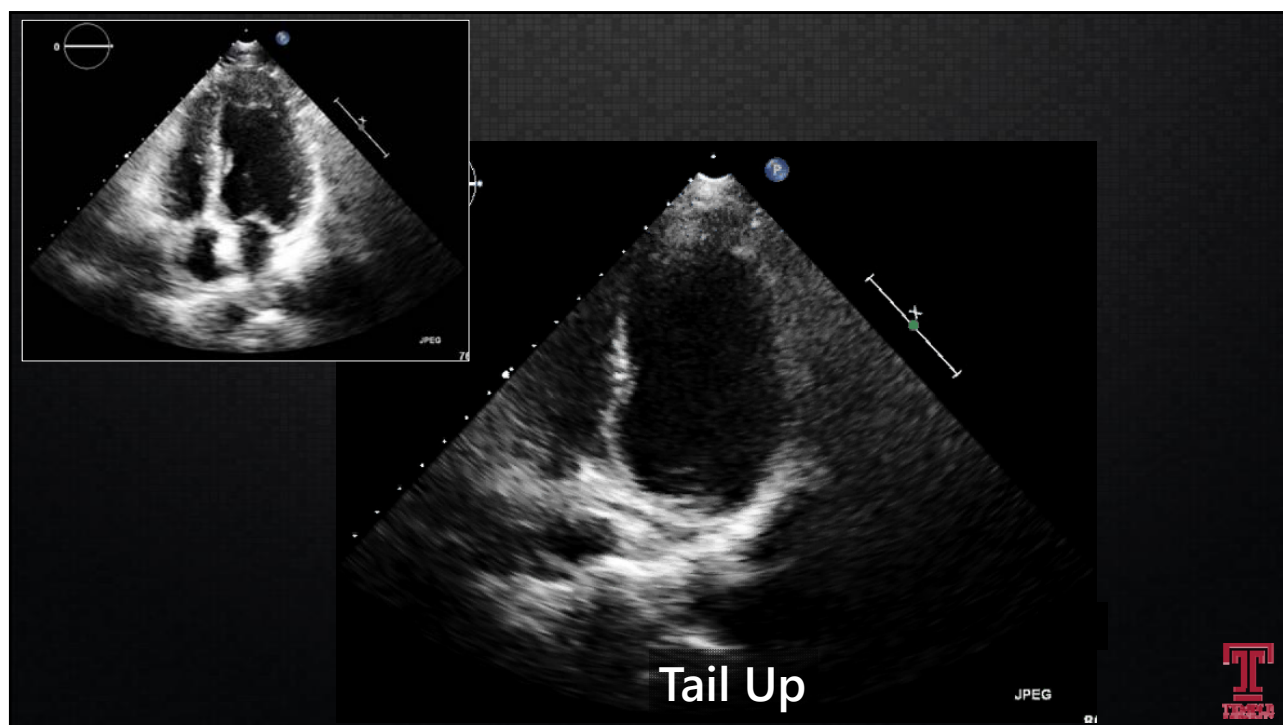
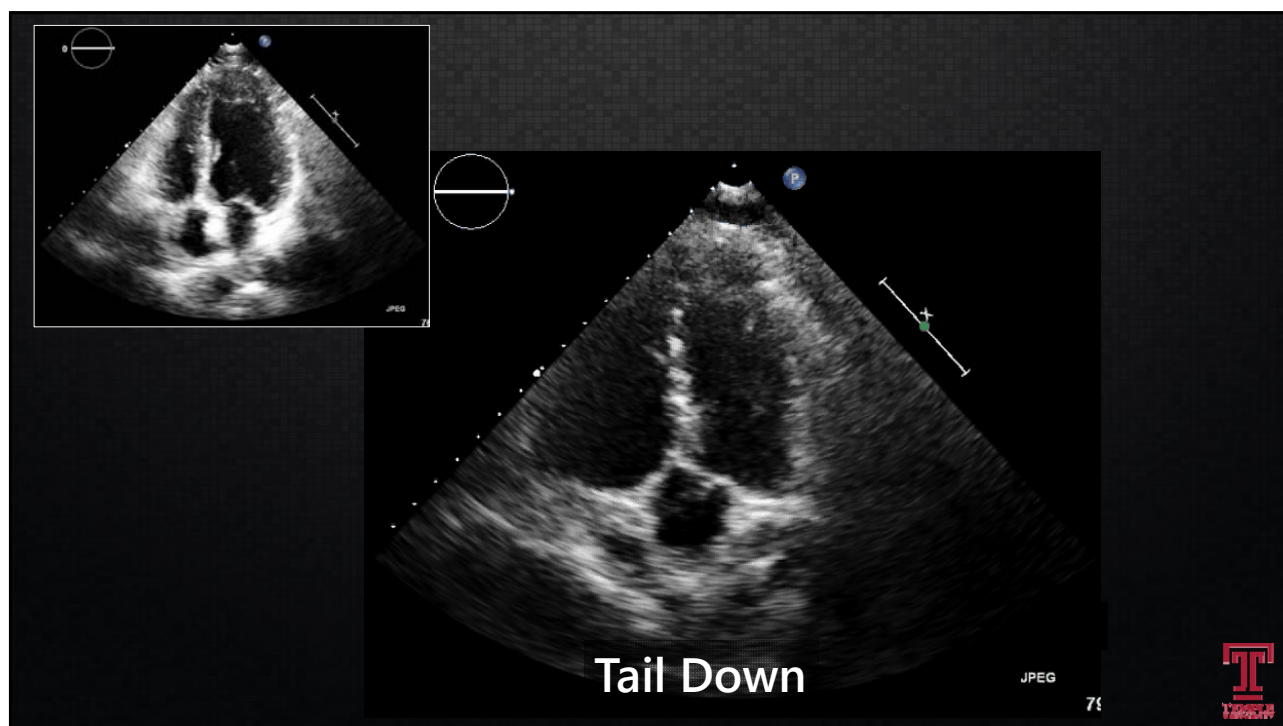


- Transducer on apical impulse
- Tilt the transducer to pan the heart and visualize 4 chambers
- Index marker to the axilla
- Depth: 14-18 cm

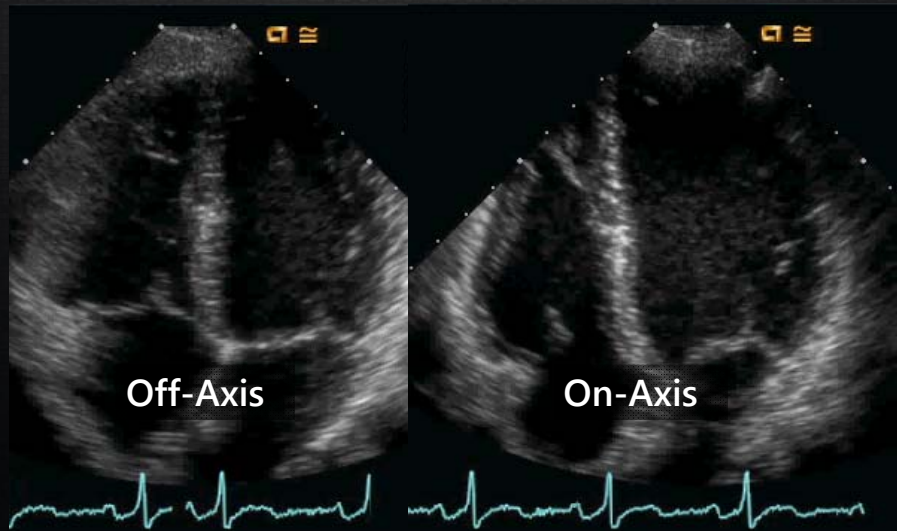


Apical Four Chamber

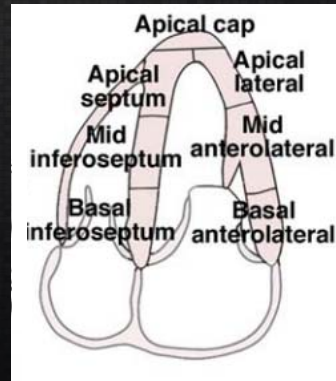
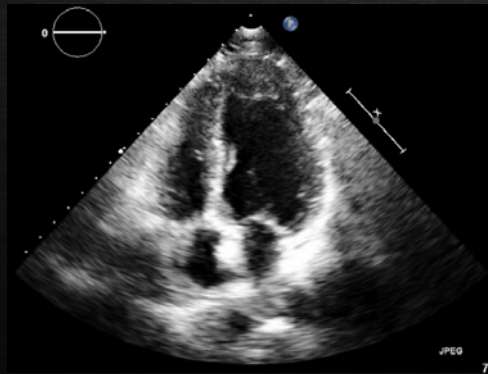




Apical 4 Chamber



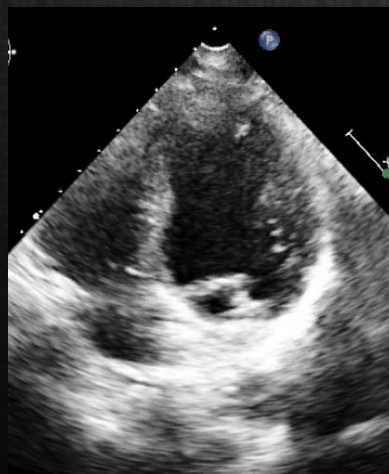
ASE/AHA 17 Segment Model



ASE Chamber Quant Guidelines, JASE 2015



Normal?



Apical Foreshortening

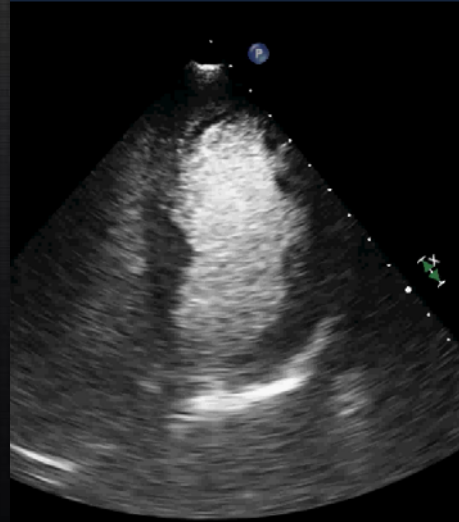


Poor Endocardial
Border Definition



Contrast for LV Opacification

- ✓ Commercial Contrast
 - Improve endocardial border definition
 - Eliminate foreshortening
 - Evaluate for mural thrombi
 - Restore diagnostic quality



ASCeXAM Focus

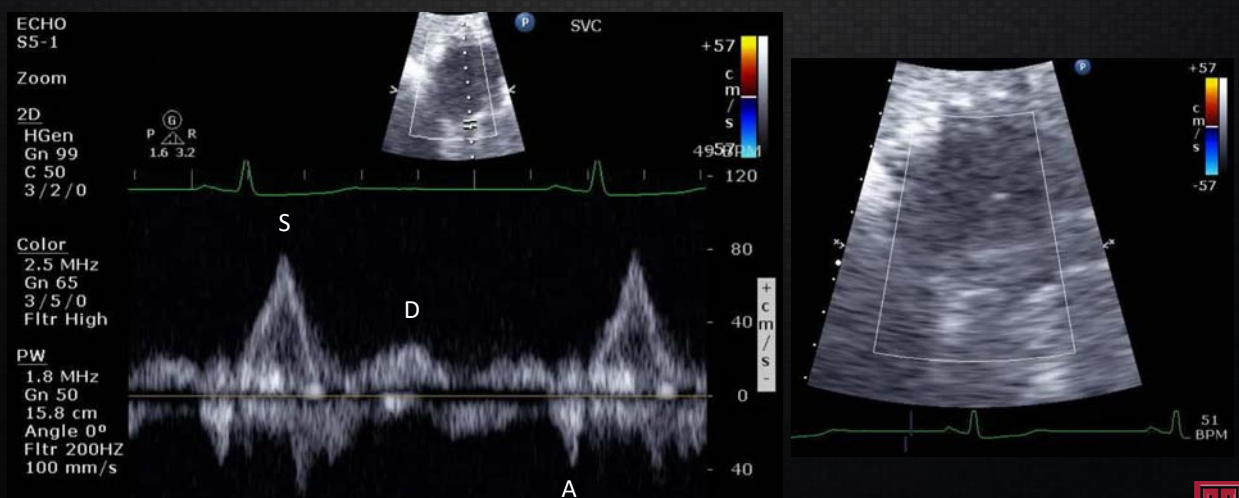
- ✓ How do you fix this image?
 - Recognize off-axis views
 - Imaging from wrong interspace
 - Foreshorten cardiac structure
 - Contrast use and optimization
- ✓ Anatomical identification
- ✓ Myocardial segment identification
- ✓ Extracardiac findings recognition
- ✓ Common Artifacts



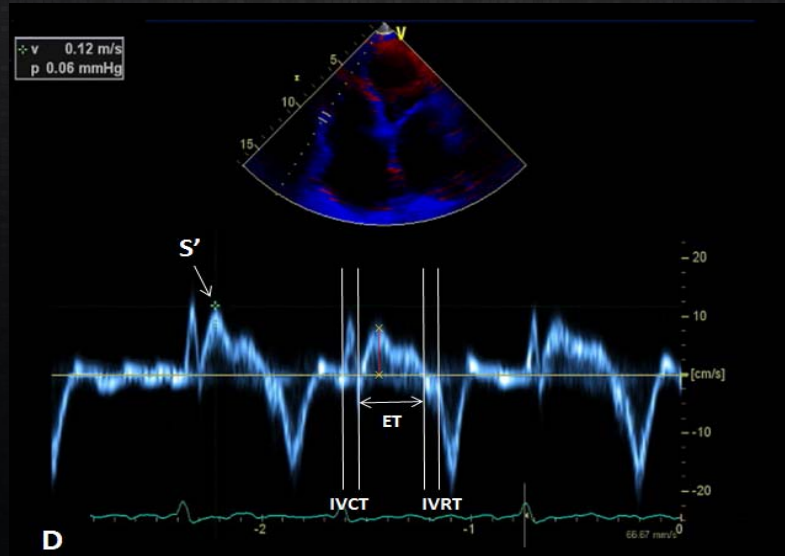
Normal Antegrade Doppler



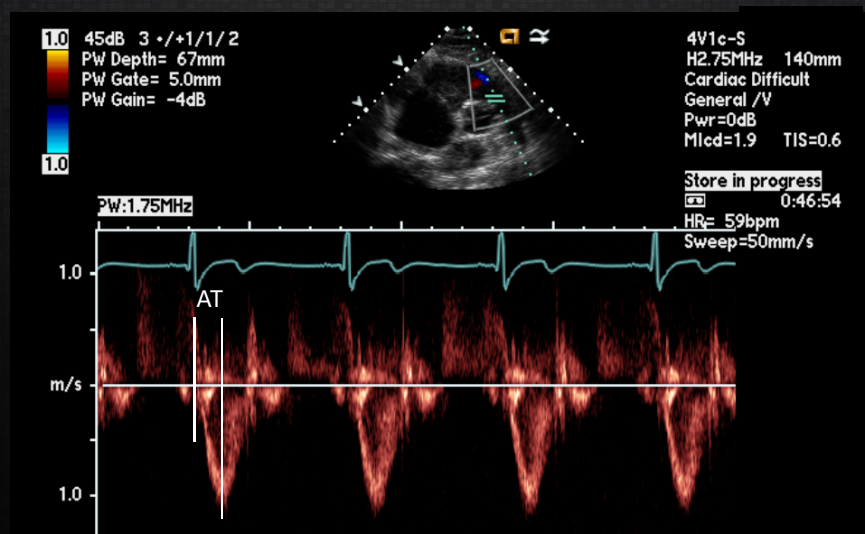
SVC Doppler



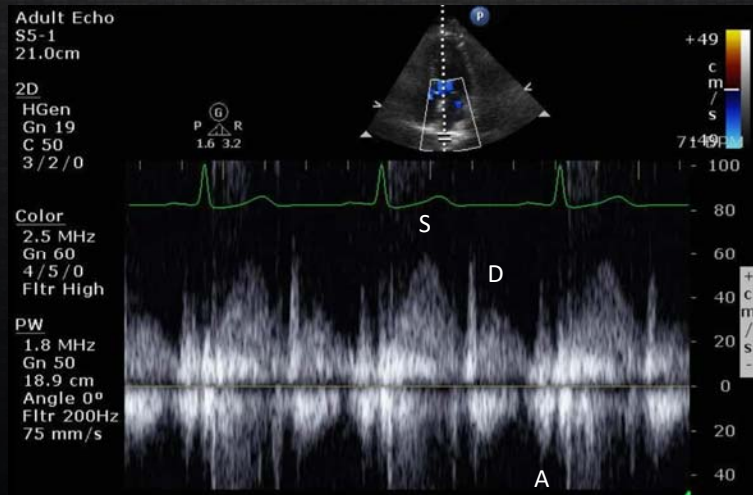
RV Tissue Doppler MPI



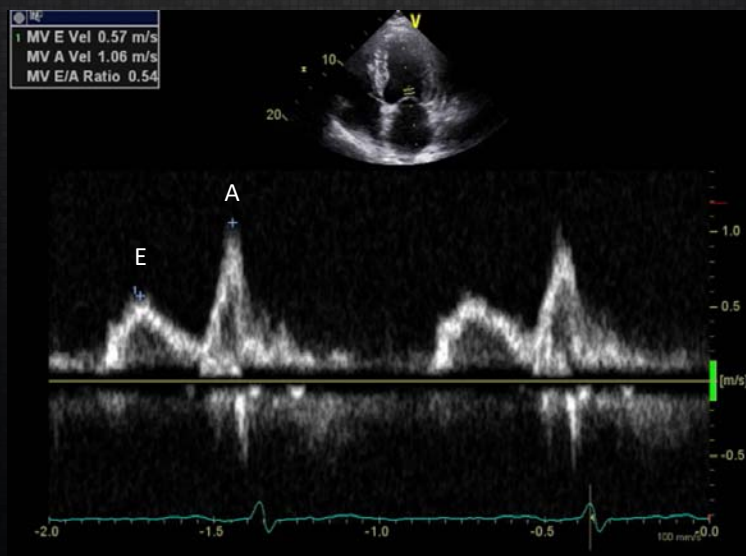
RVOT Doppler



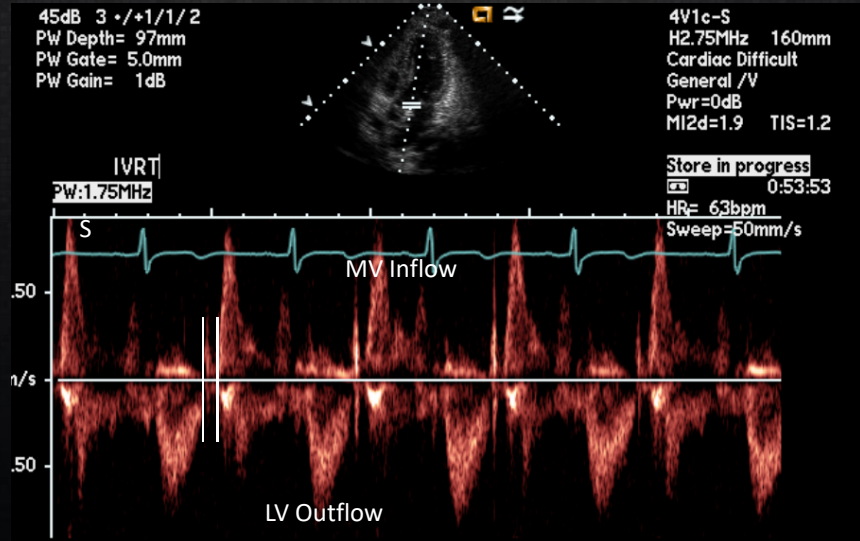
Pulmonary Vein Doppler



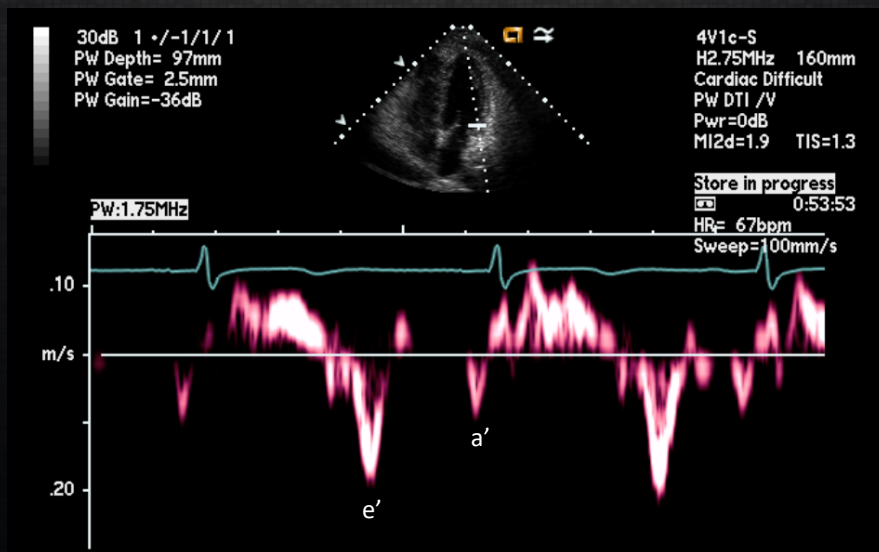
Mitral Inflow Doppler



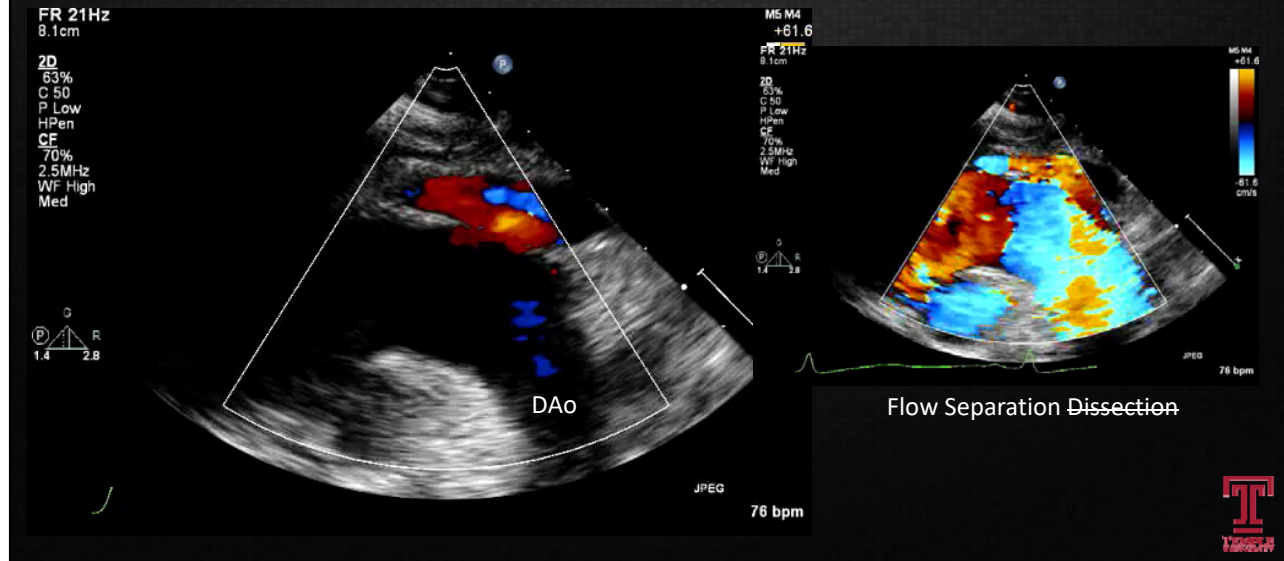
IVRT



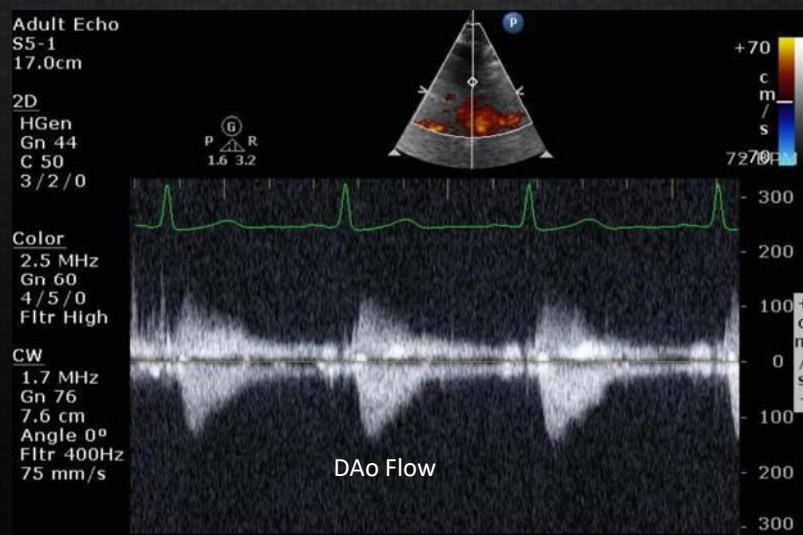
Lateral Annulus Tissue Doppler



Suprasternal Notch



Descending Aorta Doppler



ASCeXAM Focus

- ✓ Recognize normal antegrade color flow and spectral Doppler patterns
- ✓ Distinguish artifact from pathologic flow
- ✓ Optimize the acquisition of Doppler echocardiography



Normal Cardiac Structures



Persistent Venous Valves

Chiari Network

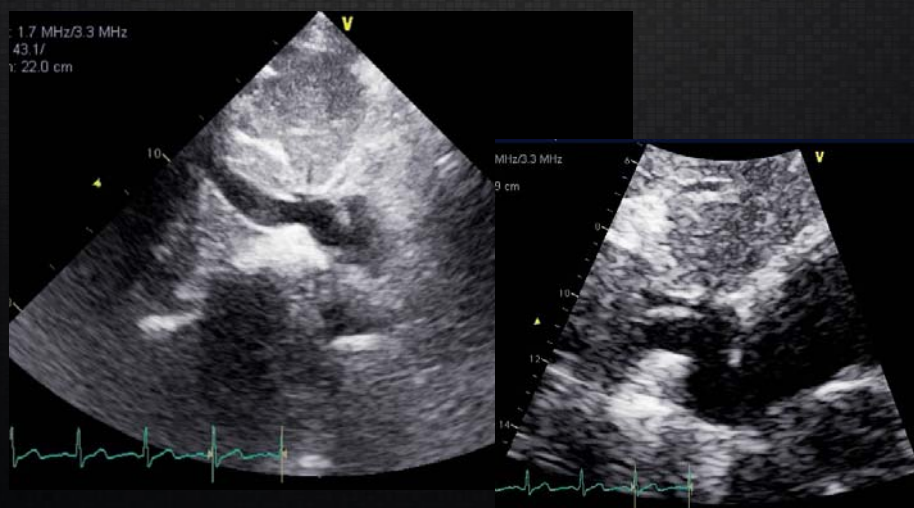
- ✓ No known function
- ✓ Not present in every patient
- ✓ Netlike structure that is a highly mobile remnant of sinus venosus
- ✓ Usually arises from the vicinity of the IVC not attached to the septum

Eustachian Valve

- ✓ Directs IVC flow across fossa ovalis in fetus
- ✓ Present in every fetus
- ✓ Ridge of tissue - rarely mobile at all
- ✓ Arises from the IVC and runs to the fossa



Eustachian Valve



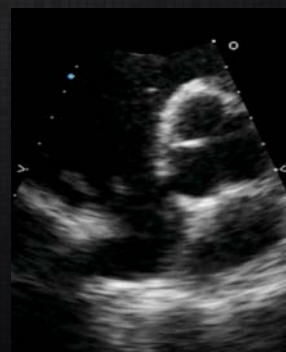
Chiari Network



RV Inflow



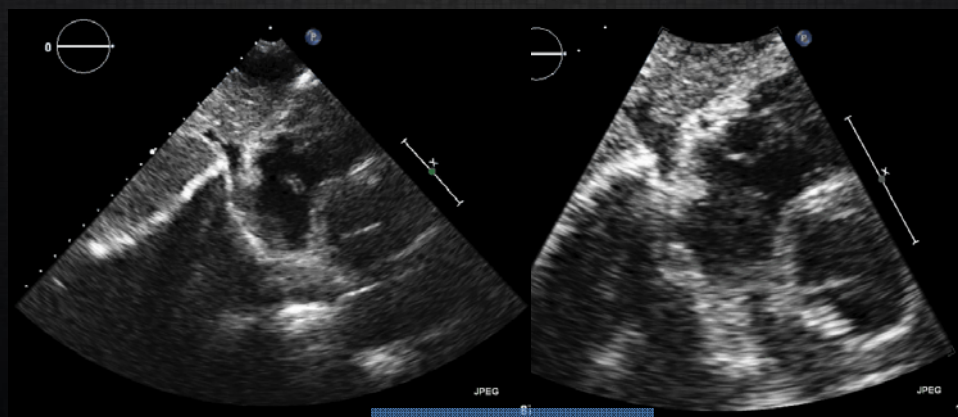
Apical Four



PSAX



Venous Valves



Subcostal

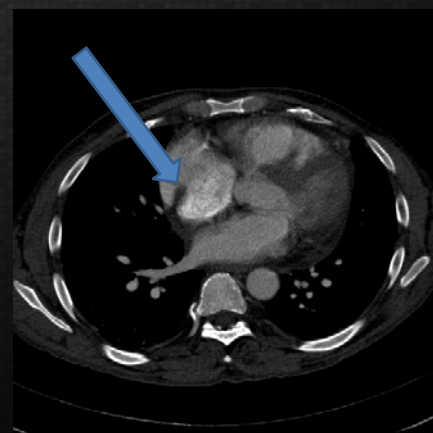
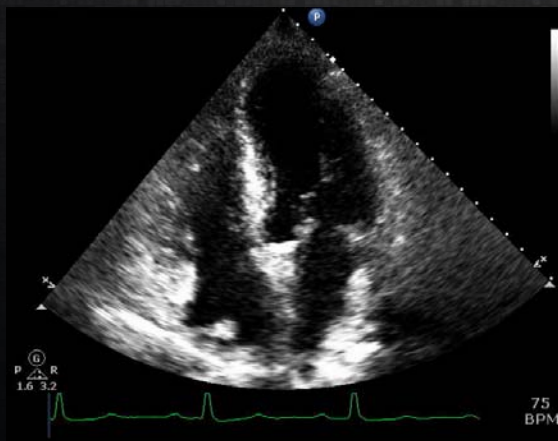


Crista Terminalis

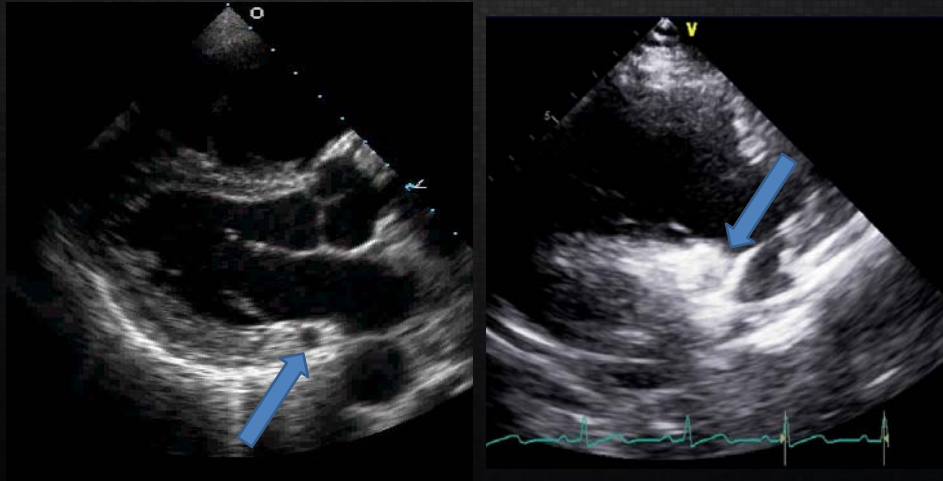
- ✓ Normal structure
- ✓ Often confused for a right atrial mass
- ✓ Smooth myocardial ridge from RA-SVC junction along posterolateral RA wall



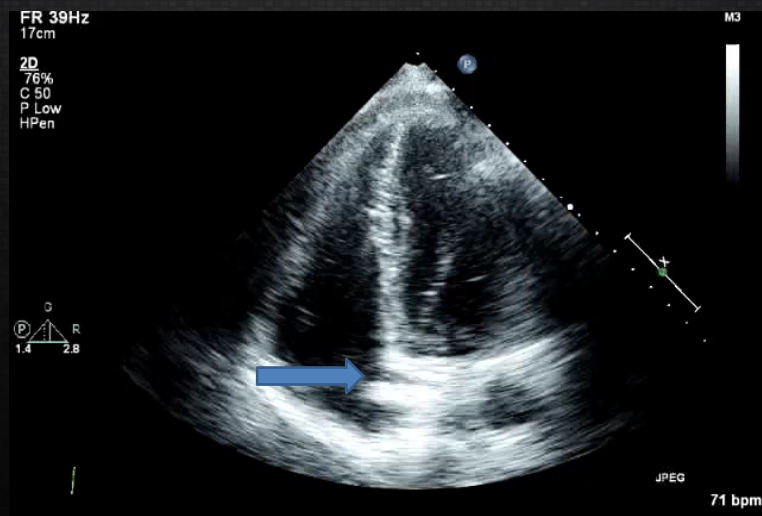
Crista Terminalis



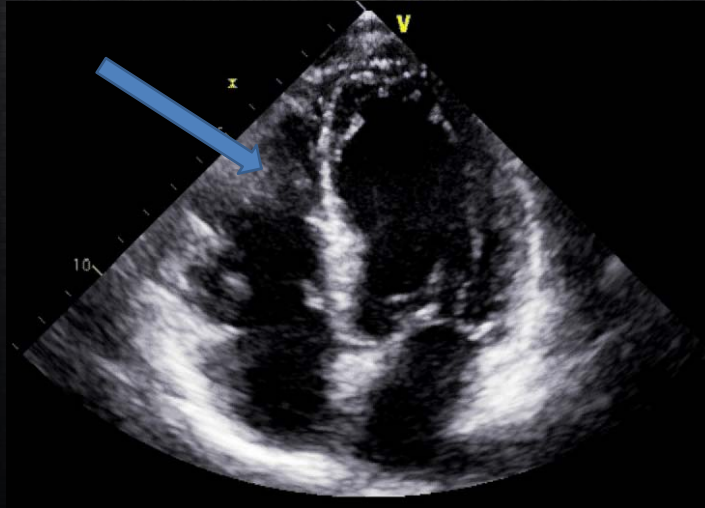
Coronary Sinus



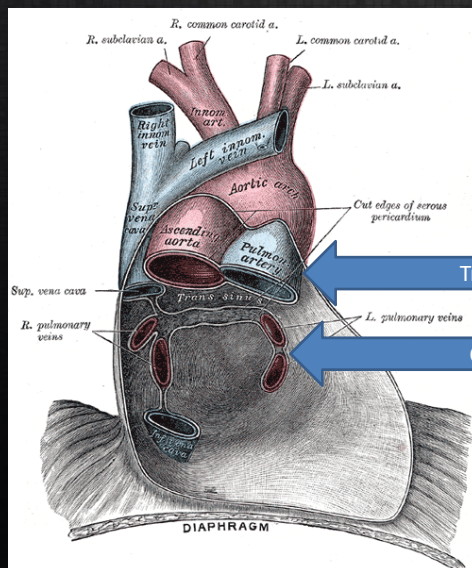
Coronary Sinus



Moderator Band



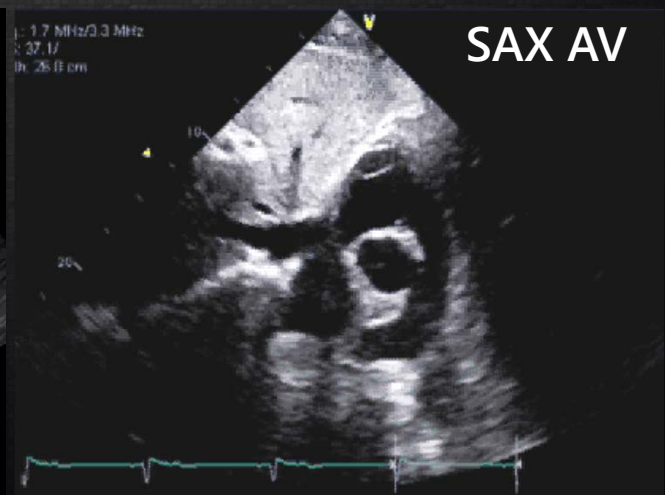
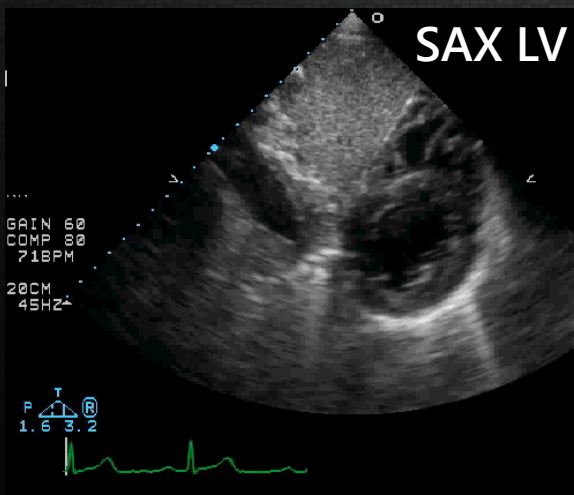
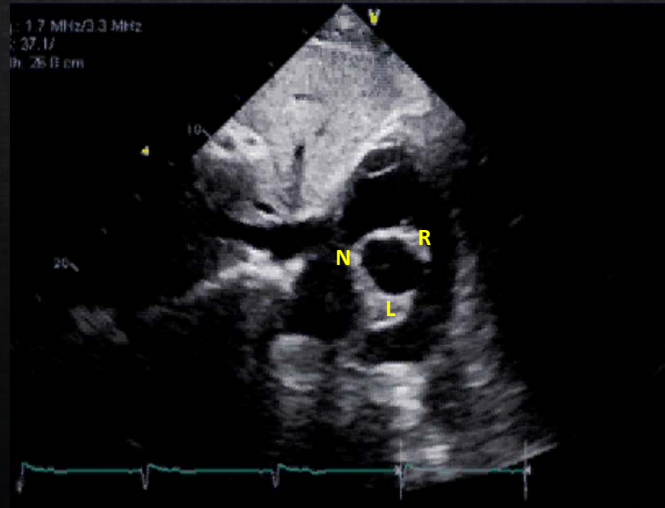
Pericardial Sinuses



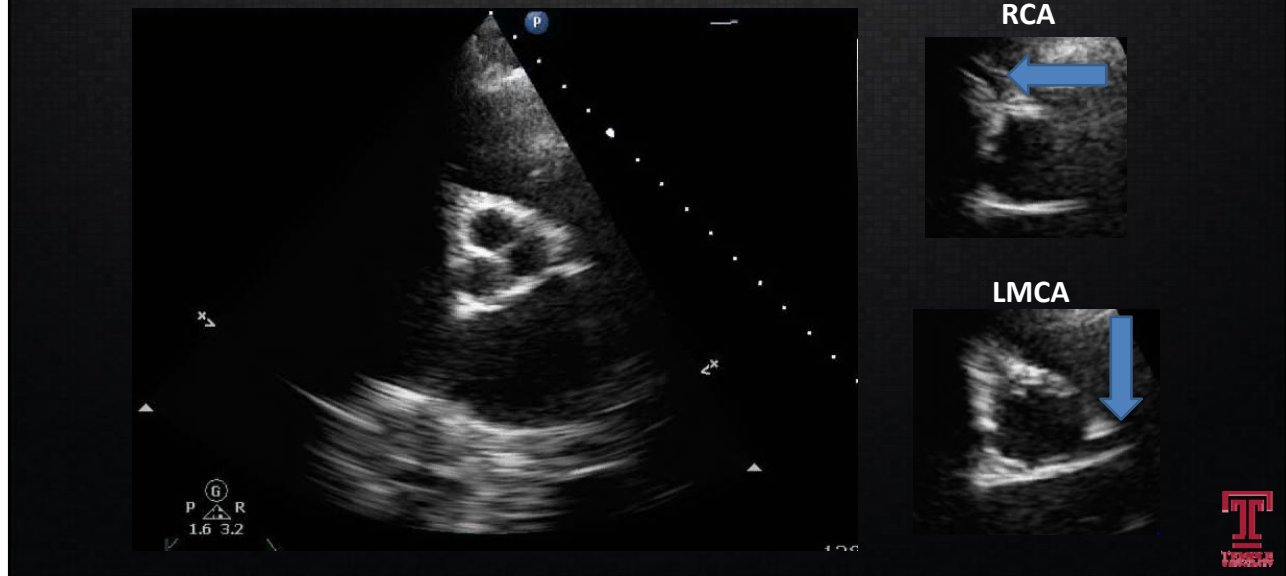
Mnemonic



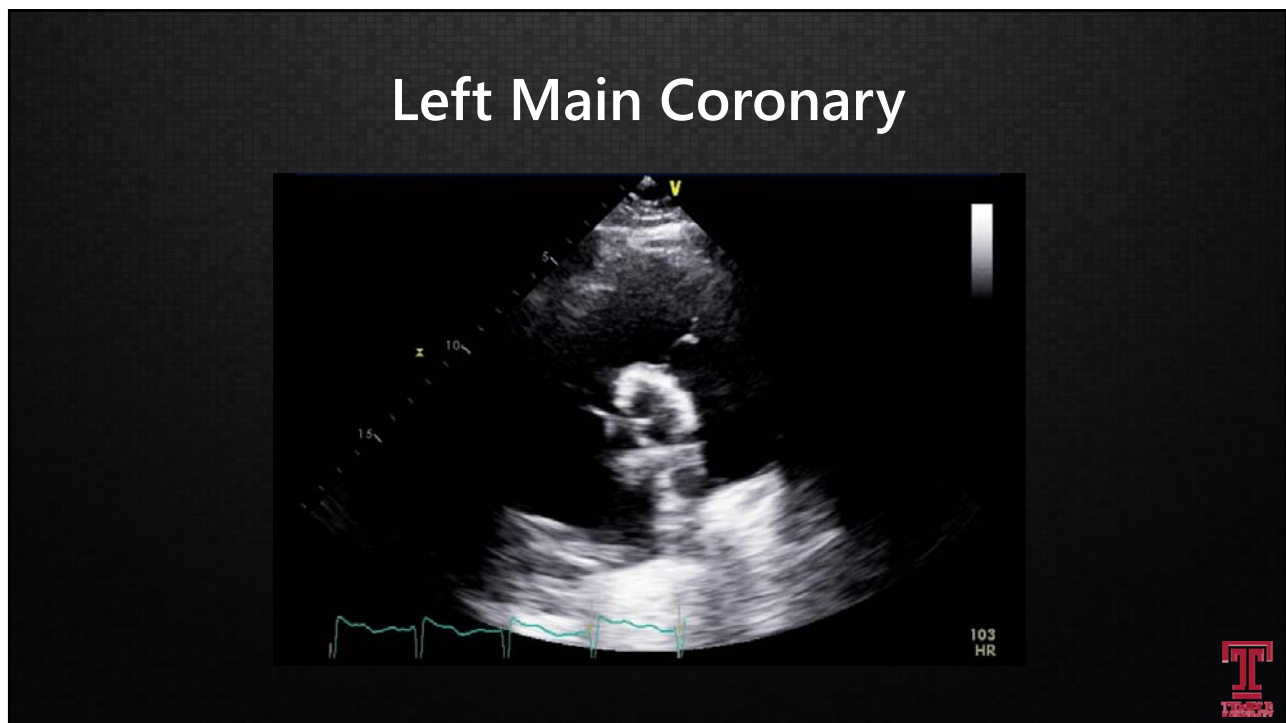
Subcostal SAX Aortic Valve



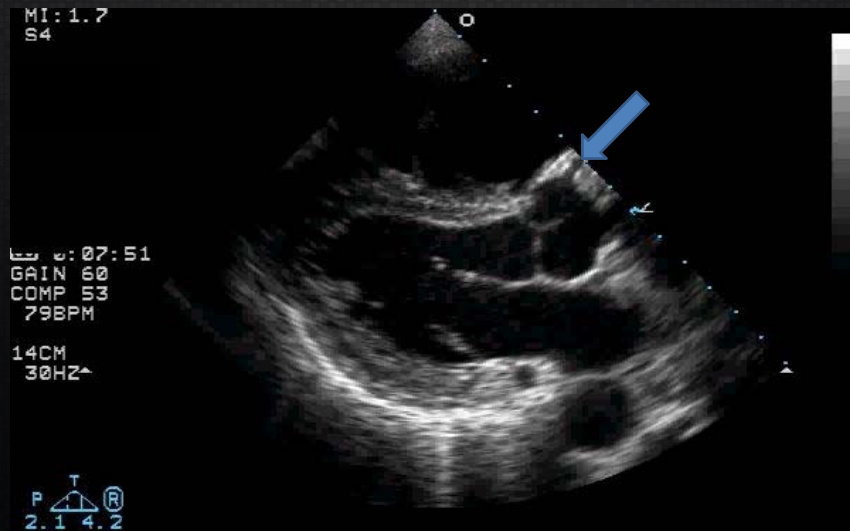
Coronary Arteries



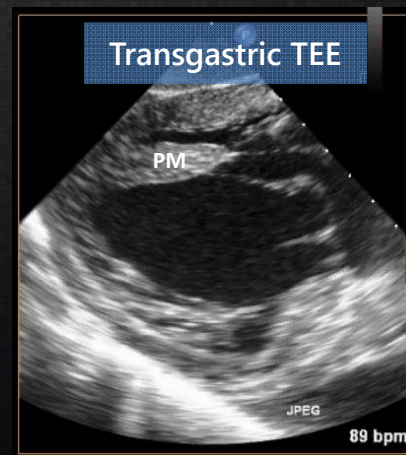
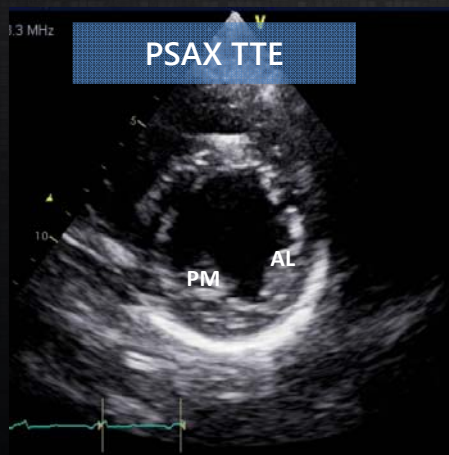
Left Main Coronary



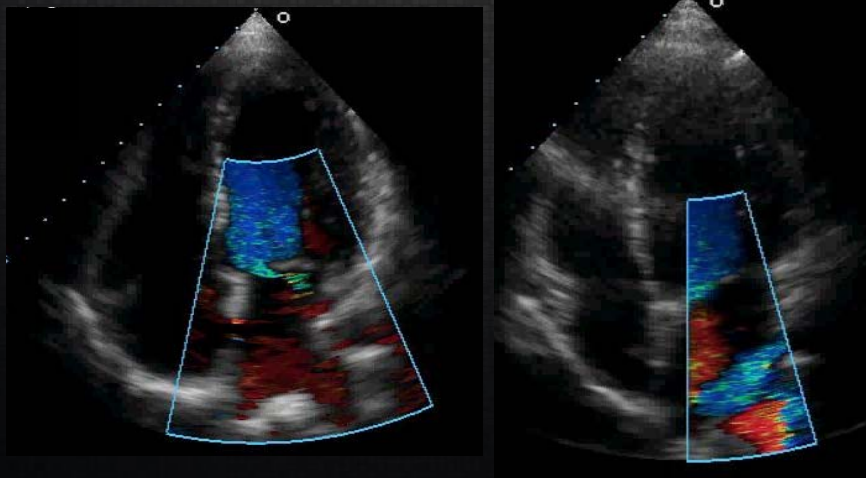
Right Coronary



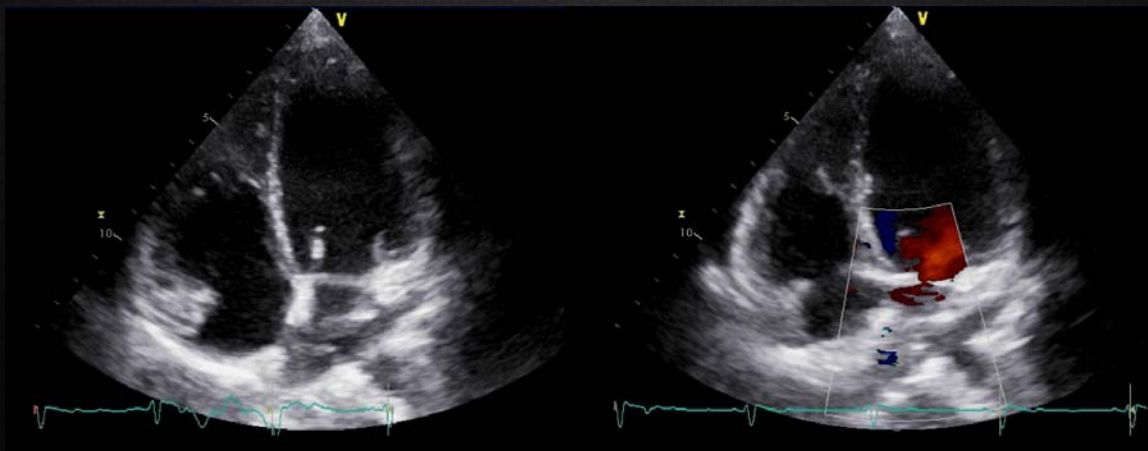
Papillary Muscles



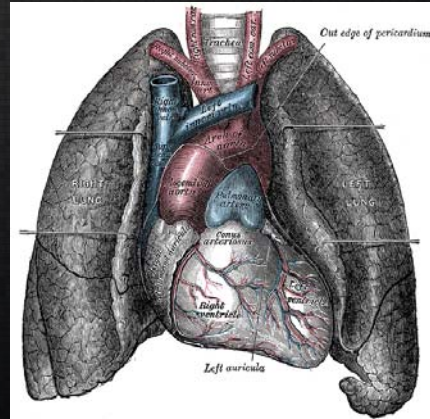
Pulmonary Veins



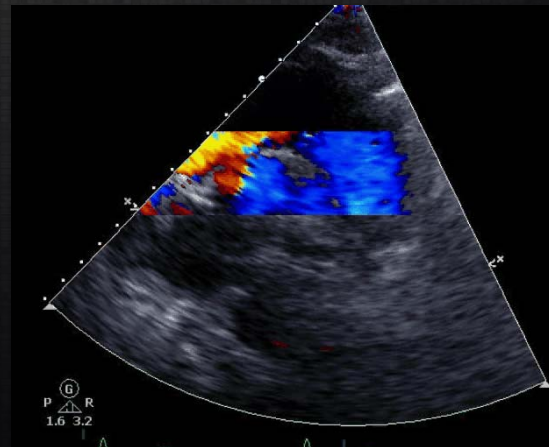
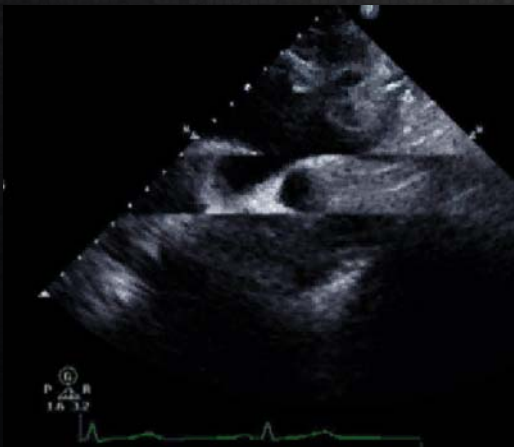
Pulmonary Veins



Suprasternal Notch



Suprasternal Notch



ASCeXAM Focus

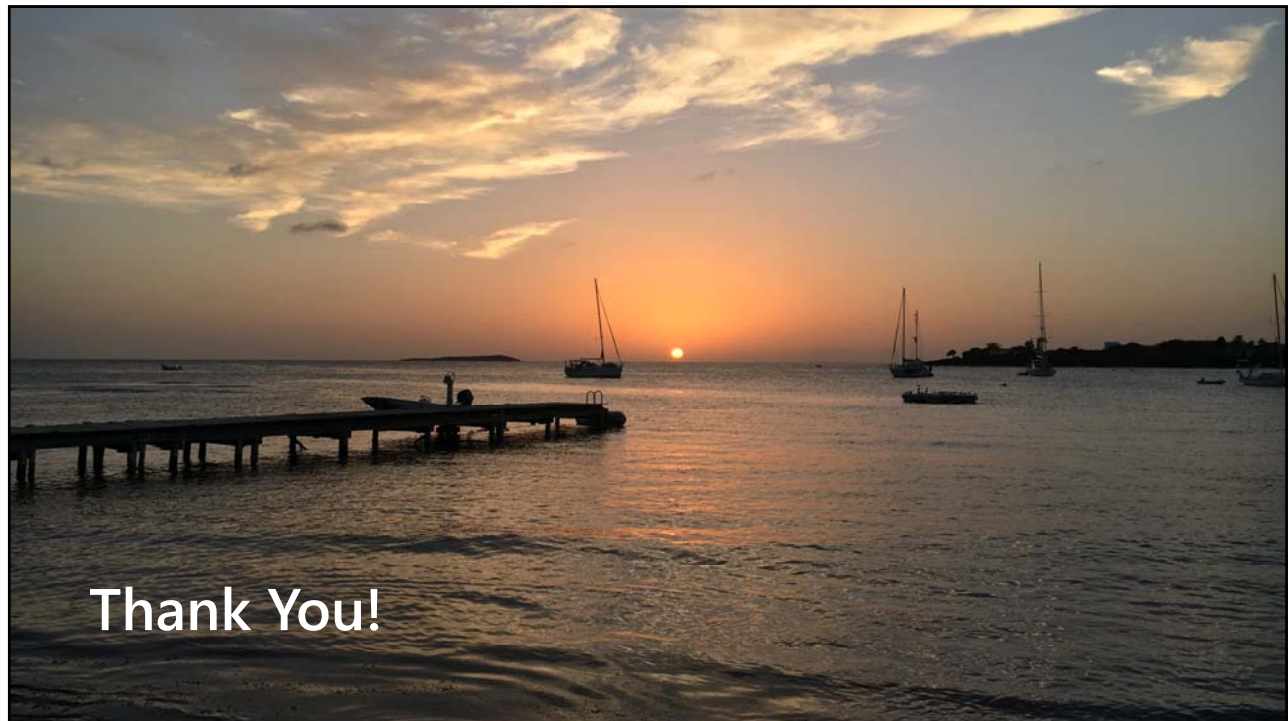
✓ Normal Anatomic Structures

– Right Heart

- Persistent Venous Valve
- Crista Terminalis
- Coronary Sinus
- Moderator Band

– Left Heart

- Pericardial Sinuses
- Pulmonary Veins
- Coronary Arteries
- Papillary Muscles
- Suprasternal Notch



Thank You!